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Review Article

Surgical and Non-Surgical Management Strategies for Lateral Epicondylitis

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Abstract

Lateral epicondylitis (LE) is one of the major causes of elbow pain. Despite being a self-limiting condition, its high incidence can cause a significant socioeconomic burden. Many treatment modalities have been proposed for the treatment, but the optimal strategy is still unknown. In this article, we discuss surgical and non-surgical strategies for the treatment of LE and address the research gaps.

Keywords: Exercise Therapy; Lateral Epicondylitis; Tennis Elbow; Treatment

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Background

Lateral epicondylitis (LE), otherwise known as "tennis elbow" is characterized by pain and tenderness over the lateral epicondyle of the humerus during the loading of the wrist extensor muscles. It affects 1-3 percent of the general population without any gender difference and usually presents between 35 and 54 years of age (1, 2). Individuals with repetitive motions of the forearm and/or fine motor skills, such as heavy manual laborers and tennis players, are at high risk of LE (3). Smoking and obesity are also associated with disease development (4).

LE tends to cause a significant economic and social burden due to the inability to perform routine activities and missed workdays. However, it is mostly a self-limited disease with symptom improvement in 70% to 90% of patients in weeks and complete resolution within a year (5, 6). There are numerous treatment options for this condition, but none are completely effective. In addition, in up to one-third of patients, the pain lasts more than a year which requires surgical treatment (7).

Here, we discuss surgical and non-surgical management strategies of LE based on available evidence and address research shortcomings in this field.

Non-Surgical Management Strategies

I. Physiotherapy

Physiotherapy is almost always a part of any treatment regimen used for LE specially in the first 8 weeks (8, 9). Physiotherapy for LE consists of two main components: manual therapy and exercise therapy, which may or may not be used as a combination. When used in combination, there might be a better effect on clinical indicators such as pain-free grip (10). Manual therapy must be performed according to Mulligan's mobilization with movement (MWM). Ulnar-humeral lateral glide and radial head posteroanterior (PA) glide are two techniques used in the treatment of LE (10).

I-A. Exercise Therapy: The core principle of non-surgical management of LE is exercise. It has been proved to be beneficial as a part of a physical therapy regimen or separately (11). Some studies favor eccentric over concentric exercise (11-14). Eccentric exercise is performed by stretching of extensor compartment with an applied load. This type of exercise has been proved to be superior in comparison with other therapeutic modalities (12). Although useful, the optimum interval, duration, and intensity of this exercise have not been studied and there is a need for further investigations (14). In this section, we discuss common exercises.

I-A1. Wrist Extensor Stretching: This exercise consists of putting an elbow in full extension (with palms facing the ground) and wrist in 90° dorsiflexion while the opposite hand pushes the palm (Figure 1). The pressure should not induce pain and feeling a gentle stretch inside the forearm is enough. The stretched position should be kept for at least 15 seconds and the patient should perform the exercise for both sides 4 times a day (15).

Figure 1. Right wrist extensor muscles stretching

I-A2. Wrist Flexor Stretching: With the elbow in full extension (palms facing down) and wrist in 90˚ palmar flexion, the opposite hand is used to bend the hand toward the body until feeling a gentle stretch (Figure 2). Similar to the previous exercise, the position should be kept for at least 15 seconds and stretching should be repeated 4 times a day for both sides. This exercise could be done as a warm-up before activities involve gripping.

Figure 2. Right wrist flexor muscles stretching

I-A3. Wrist Extensor Strengthening: To perform an isotonic exercise of eccentric wrist extension (16), the patient should put the elbow in 90˚ flexion while supporting its weight by a stable surface with the wrist on the edge and palm facing the ground (Figure 3).

Figure 3. Right wrist eccentric extension exercise, starting position

Then the wrist is flexed upward to its maximum capacity, kept in position for 1 second, and then, slowly flexed downward (Figure 4).

Figure 4. Right wrist eccentric extension exercise, ending position

Depending on the severity of the pain felt by the patient during the exercise, it may be performed with or without a dumbbell (Figures 5 and 6).

Figure 5. Right wrist eccentric extension exercise with dumbbell, starting position

Each full wrist extension and flexion should take 5 to 10 seconds and the patient needs to repeat the exercise for both sides 10 times a day (11). In addition, the wrist extension can be performed with elbow in 180˚ extension using the same method to put more stress on extensors.

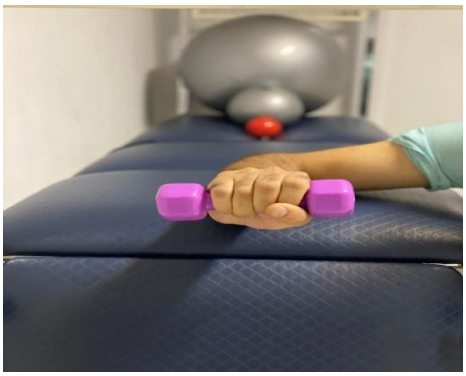

Figure 6. Right wrist eccentric extension exercise with dumbbell, ending position

I-A4. Wrist Flexor Strengthening: With the elbow in 90˚ flexion, its weight is supported with a stable surface by putting the wrist on the edge (palm facing up). Like the previous exercise, the wrist is flexed upward to its maximum capacity and kept in position for 1 second. Then, it is flexed downward slowly. To achieve better results, the patient can use a dumbbell if the pain is endurable. Each full wrist extension and flexion should take 5 to 10 seconds and the patient should repeat the exercise for both sides 10 times a day.

I-A5. Twist Exercise: In this exercise, the patient should grip a flexible bar by the affected hand, with the wrist in maximum extension, the elbow in 90˚ flexion, and the free end of the bar pointing up. The opposite hand grips the other end of the bar and twists the bar until the wrist reaches full flexion. Then, the elbows are fully extended in front of the body while both wrists are maintained in their previous positions. Finally, the affected wrist should be allowed to slowly become flexed by the force exerted by flexible bar untwisting (14).

I-B. Physiotherapy Modalities

I-B1. Shockwave Therapy: Many studies have been conducted on shockwave therapy effectiveness in the past decade. In this therapeutic method, the shockwaves are aimed to the interstitial and extracellular responses that lead to tissue regeneration (17, 18). The absence of control groups and uniform treatment in these studies has yielded inconclusive results (19-21).

Recently, few studies with better design and similar treatment protocols have been published (22-24). In two meta-analyses comparing shockwave therapy with corticosteroid injection or ultrasonic waves, it has been proved that shockwave therapy is superior in terms of visual analog scale (VAS) and handgrip strength (25, 26). In a clinical trial, Ahadi et al. compared shockwave therapy with prolotherapy, ultrasound treatment, or placebo and found that shockwave therapy was significantly more effective than prolotherapy (27). In a recent study by Celik and Anaforoglu Kulunkoglu, photobiomodulation showed better efficacy in improving VAS and handgrip scores compared to shockwave therapy (28). Based on available evidence, shockwave therapy is not appropriate for acute LE, but is recommended when symptoms persist for more than 6 months or after the failure of other conservative treatments (8).

I-B2. Taping: Various taping techniques have been suggested for the treatment of LE (29). Although several studies have discussed the efficacy of taping procedures, a case-control design was not used and the evidence was low-quality (29, 30). Thus, it is unclear that the observed effects are due to the taping procedures or the course of the disease itself.

In a systematic review by George et al. in 2019, it was highlighted that with the current evidence, making a suggestion regarding efficiency of taping was not reasonable (30). In a meta-analysis, Zhong et al. investigated randomized controlled trials (RCTs) involving Kinesio taping (KT) (Figure 7) and concluded that this treatment improved VAS, handgrip, and the score of the Disabilities of the Arm, Shoulder and Hand (DASH) compared to placebo or physiotherapy (31). The main limitations of these RCTs were small sample size, various taping techniques, different treatment protocols, and short follow-up periods. Although the recent data have shown promising results, drawing a certain conclusion on this matter needs further studies with a uniform treatment strategy.

Figure 7. Kinesio taping (KT) to relieve tension of right extensor muscles

I-B3. Acupuncture: Rooted in traditional Chinese medicine, acupuncture has been used widely as a treatment for pain relief in different musculoskeletal disorders (32-34). This method is also used in the treatment of LE. Although the definite mechanism of acupuncture is still unknown, it may increase local blood flow and cause neurotransmitter release which can facilitate healing and cause analgesia (35). In a recent meta-analysis of the RCTs by Morley et al., acupuncture has shown to be efficient and successful in relieving pain (36). Although many studies comparing acupuncture with different therapeutic methods have shown the benefits of acupuncture, most of them suffer from a small sample size (37-39).

There is a lack of data regarding acupuncture's long-term effects and possible side effects. Like many other procedures, acupuncture can be performed by different therapeutic instruments and on diverse locations. Due to the diversity of the therapeutic methods used by different studies, we cannot draw any conclusions regarding acupuncture's efficacy.

II. Medications

II-A. Nonsteroidal Anti-Inflammatory Drugs (NSAIDs): Different oral NSAIDs have been used to treat LE. The use of tenoxicam, piroxicam, flurbiprofen, diclofenac, and naproxen has been effective in pain reduction but limited by gastrointestinal (GI) adverse effects (8). On the other hand, topical NSAIDs have favorable short-term effects and seem to possess no GI side effects (40). Although the NSAIDs may have short-term pain relief effects in LE, the long-term outcome is unclear and they cannot stop the disease progression (40, 41).

II-B. Steroid Injection: Introduced in the 1950s, corticosteroid injection is now one of the most widely-used treatments for LE (42, 43). In recent years, corticosteroid treatment has lost its popularity among practitioners due to the long-term inefficacy and side effects (44, 45). It has been associated with a rapid pain reduction in LE, but its effect on functional recovery is questionable. Although effective in the short term, corticosteroid injection is associated with relapses and poor long-term efficacy compared to other treatment modalities and even no treatment (46).

Corticosteroids exert their effects by inhibition of neuropeptides and cytokines. By doing so, they might also disrupt tendon healing by inhibiting migration and proliferation of cells and inducing the differentiation of the non-tenocytes (47-49). With such mechanisms, corticosteroid injection might also delay pain recovery in the long term by postponing tendon healing. In an RCT, Smidt et al. reported that corticosteroid injection even showed poor results compared to the "wait and see" approach (50). In another study, three or more corticosteroid injections were associated with the failure of surgical treatment (51). Recent researches have linked corticosteroid injection with tendon calcification and rupture, as well as decreased muscle thickness (52-54). It might also cause hypopigmentation and atrophy in the skin (55). Although it is a rapid solution to the patient's pain and poor function, we suggest that corticosteroid injection should be used with caution after considering other treatment options.

II-C. Biological Therapeutics: A new alternative treatment for LE is the injection of biological therapeutics. In this method, biological solutions such as autologous blood (AB) and platelet-rich plasma (PRP) are injected into the affected side to reduce pain.

For AB injection, 2 ml of AB is collected from the patient and injected proximal to the lateral epicondyle along the

supracondylar ridge in combination with lidocaine or bupivacaine (56). The needle should advance into the inferior surface of the extensor carpi radialis brevis muscle. These therapeutics contain growth factors that are beneficial for soft tissue healing. Moreover, an inflammatory reaction might be involved in the therapeutic effects observed with this treatment (57).

PRP is one of the biological products that have been intensively studied in the past few years. It is a derivate of AB which contains a more concentrated amount of platelet. There is no standard technique for the preparation of PRP. It can be prepared by centrifuging 15-20 ml of AB and could be injected in combination with different substances (56).

Consensus data suggest that AB and PRP are both superior to corticosteroid injection in terms of side effects and long-term effects, but corticosteroid injection has shown better outcomes in the short term (46, 58-60). A systematic review by Tang et al. suggests that PRP is superior to AB in terms of side effects (59). Various meta-analyses have been performed on RCTs addressing biological therapeutics injection (49, 58-61). Only one of them investigated PRP efficacy versus placebo treatment, and surprisingly, it found that there was no difference between them in terms of short- or long-term effects (61). This paradoxical finding might be due to the selection of saline as a placebo injection by many studies (62-64). As it was previously mentioned, LE is a self-limiting condition. Hence, it is of importance to compare each treatment with a placebo rather than other types of treatments.

To draw conclusions about biological therapeutics, we need studies that address different variables such as volume of injections, number of injections, injection intervals, and follow-up periods.

II-D. Botulinum Injection: Several studies have reported that botulinum injection can reduce pain in LE (65, 66). However, its application is associated with weakness. In a meta-analysis by Krogh et al., botulinum injection showed to be more effective than placebo injection, but less effective than corticosteroid injection in the short term and was associated with more grip weakness. This study also suggested that the duration of botulinum effect in LE was about 16 weeks (53). Based on available evidence, more studies with better study design and botulinum toxin dosage are required.

II-E. Saline Injection: Although considered as a placebo treatment, it has been recently postulated that saline injection might hold clinical and therapeutic effects in some musculoskeletal conditions such as LE. In a meta-analysis by Gao et al., the saline injection has shown therapeutic effects comparable to corticosteroid, PRP, autologous conditioned plasma (ACP), and botulinum injection (62). It has also successfully improved pain and functional scores (64). Whether these effects are a placebo effect or a property of the saline solution is unclear (62).

Surgical Management Strategies

Surgery is the last resort for the treatment of LE. There are three main surgical approaches for this condition: open, arthroscopic, and percutaneous. Since the introduction of open surgery for the treatment of LE, this approach has evolved profoundly. The denervation of lateral epicondyle was one of the first procedures introduced by Wilhelm and Gieseler (67). Boyd and Mcleod introduced an open release procedure that includes removal of the annular ligament's proximal part and release of the epicondylar enthesis (68). Their technique was soon replaced by the Nirschl technique (69).

The main superiority of arthroscopic approaches in the treatment of LE is the ability to see intra-articular abnormalities, quicker recovery, and faster return to work (70). Although the percutaneous approach is not able to examine intra-articular abnormalities, it provides quicker recovery and better patient satisfaction. There are reports suggesting the same efficacy for the percutaneous approach compared to the open and arthroscopic methods (71). However, in one study, it was reported that open and arthroscopic approaches might result in higher DASH scores (72).

Radiofrequency microtenotomy is another method that has been successfully used in the treatment of LE. Results from comparative studies performed on radiofrequency microtenotomy and other surgical interventions have shown similar efficacy (73).

In recent years, promising results have been published on application of percutaneous ultrasonic tenotomy (72). This method has been used in a variety of orthopedic disorders and the majority of studies have shown satisfactory application of this procedure (74). Only one study compared this novel method with the previously-existing methods and reported a similar efficacy (75). However, it failed to report details of surgical procedures and had a very small sample size. Thus, the superiority of this method is yet to be determined.

Reports suggest a less than 10% failure rate for LE surgery (76). Various causes have been proposed for the failure of LE surgery. The most common cause of failure is patient non-compliance and inadequate rehabilitation (77). Another cause of surgical failure might be a concomitant orthopedic condition or inaccurate diagnosis (77). Radial tunnel syndrome (RTS) is one of the main causes of inaccurate diagnosis. In one study, up to 30% of patients diagnosed with LE were suffering from entrapment of the posterior interosseous nerve (78). Elbow instability and intra-articular complications such as synovial plica, synovial fistula, and osteoarthritis (OA) might also contribute to surgical failure and poor surgical outcomes. In 11% to 69% of patients affected by LE, intra-articular pathologies have been found (76). Surgical treatment in these cases usually results in worsening of symptoms or might contribute to the development of a different symptom complex (77).

Conclusion

The treatment of LE is based on exercise therapy. There is no consensus regarding the next step in unresponsive patients due to the lack of evidence. PRP and shockwave therapy have shown promising results in comparison with other treatments. None of the existing surgical procedures have shown absolute superiority over each other. Although promising results have been observed with percutaneous ultrasonic tenotomy, further investigations are necessary.

Conflict of Interest

The authors declare no conflict of interest in this study.

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